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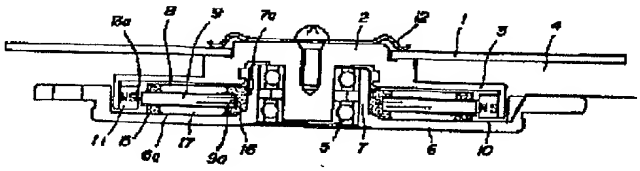
INT.CL. : H02K 29/00 H02K 5/08 H02K 5/24
H02K 21/22

TITLE : SPINDLE MOTOR FOR DRIVING MAGNETIC DISC



ABSTRACT : PURPOSE: To suppress noise by lessening at least one side of a stator and a rotor.

CONSTITUTION: The vibration and the noise mainly in a stator are suppressed while lessening the influence of dust by injection-molding or cast-molding a stator core 9 and its winding 8, or the stator core 9, its winding 8 and a printed board 10 for letting a current to this winding 8 each integrally, with plastic resin 15, and similarly the vibration on rotor side can be suppressed by paying attention to the structure, too, on rotor side 3, and further the vibration of both the stator and the rotor can be suppressed.

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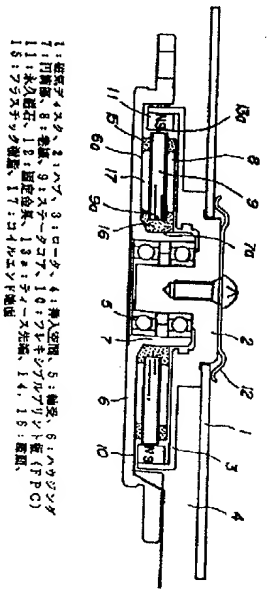
(54)【発明の名称】　磁気ディスク駆動用スピンドルモータ

(57)【要約】

【目的】　ステータ，ロータの少なくとも一方の振動を少なくして騒音を抑制する。

【構成】　ステータコア９とその巻線８、またはステータコア９，その巻線８およびこの巻線８に電流を通流するためのプリント板１０をそれぞれ一体的にプラスチック樹脂１５で射出成形または注型成形することにより、塵埃の影響を少なくしながら主としてステータにおける振動および騒音を抑制し、同様に、ロータ３側の構造にも留意することによりロータ側の振動を抑制可能とし、さらにはステータ，ロータ双方の振動を抑制可能とする。



の如き値が要求される。この他、低騒音であること（例えば40dBA以下：Aはoverallの略で、全周波数領域にわたってという意味を表わす）、塵埃の発生は皆無であること、耐衝撃性が大きいことなどが要求される。ここで、ステータコアの寸法について考える。図8におけるステータコア9の厚さtsは、ロータ3の厚さtr、ハウジング6の厚さth、巻線8のコイルエンド厚さtwなどを差し引くと非常に薄く、例えばハウジング6の下面からロータ3の上面までの高さを約4mmとすると、1mmの寸法も取り得ない。一方、モータ性能を確保するためにはロータ3の外径は大きく、ステータコア9の半径方向の寸法Lsは長くなる。

【0005】次に、ステータコアの振動について考える。図9は図8のステータコアと永久磁石との関係を示すモータの上面図、図10は図9におけるティースのA－A断面図、図11はステータコアの永久磁石の高さ方向の位置ずれを説明するための概要図である。すなわち、上述のようにステータコア9のティース部（13）は図8に示すように厚さtsが非常に薄く、かつ半径方向の長さLsが比較的長いため、図9のように半径方向に放射状に延びた薄板の形を成しており、しかもステータコア9の内径部9aは図9，図10には図示していない円筒部7の外筒部7aに固定されているため、ティース13の先端部13aは図10にV1，V2で示す方向に非常に振れ易い構造となっている。そして、各ティース13に装着された巻線8（図8参照）に電流が通流制御されることにより、永久磁石11と各ティース13との間に働く電磁力によって、ティース先端部13aがカンチレバー的に、図10にV1，V2で示す方向に振動することになる。

【0006】上記のような振動は、図11に示すように、ステータコア9と永久磁石11との相対位置がモータ高さ方向（軸方向）に位置ずれを起こした場合に特に生じやすいことが指摘されている。つまり、ステータコア9と永久磁石11との磁気的中心ずれLxは、これが僅かでもあると振動が発生し、Lxが大きくなる程振動も大きくなる傾向にある。この磁気的中心ずれLxは、ステータコア9の製造工程や巻線工程の取扱いによるソリや曲がりで発生し、かつ各ティース毎にその大きさも異なる。また、ステータコア9をハウジング6に取り付ける際にも、取り付け誤差や傾きによっても発生する。したがって、全てのティースについて磁気的中心ずれLxを無くすことは殆ど不可能であるということになる。

【0007】

【発明が解決しようとする課題】ところで、上記のような振動が生じると、磁気ディスク上のデータを誤読するおそれがあるだけでなく、これが巻線に流れる電流の転流周波数と一致すると、非常に耳障りな電磁騒音を発生する。また、ステータコア9の内径部9aから図8の円筒部7に振動が伝わり、ハウジング6全体を振動させてさらに騒音が増大することになる。図12に図8の構成によるスピンドルモータの騒音分析スペクトラムの1例を示す。同図のf1は巻線に流れる電流の通電制御周波数（転流周波数）に一致し、f2，f3はその整数倍の周波数を示す。これは、要求される騒音値を満足できないばかりでなく、騒音値では表わせない非常に耳障りな特異な音であり、またモータ全体および磁気ディスク装置全体を振動させる原因ともなっている。

【0008】ここで、塵埃について考える。すなわち、ステータコアおよび巻線の製造，組立工程等においては、何らかの原因で塵埃が付着することが考えられる。各部品は空調された清浄な室内で製造されるとともに、各製造工程毎に清浄されて塵埃は殆ど除去されているが、例えば巻線工程において巻線に付着している僅かな塵埃などが巻線時に一緒に巻き込まれると、清浄によってもこれを取り去ることは困難である。この塵埃は、モータの使用中に図8に示すロータ3とハウジング6の隙間14を通って磁気ディスク1に付着し、図示されない磁気ヘッドや磁気ディスク1を損傷することになる。したがって、この発明の課題は振動を抑制して騒音を減らすこと、さらには塵埃の影響を極力少なくすることにある。

【0009】

【課題を解決するための手段】このような課題を解決するため、第1の発明では、界磁用永久磁石を備え、ハウジングの円筒内部に固定された軸受を介して回転自在に支持され、磁気ディスクが搭載されるハブと、ハウジングの円筒外周部に装着され前記界磁用永久磁石に対し僅かな空隙を以て対向するように配置されたステータコアと、このステータコアに巻回されプリント板に電気的に接続される巻線とを有してなる磁気ディスク駆動用スピンドルモータにおいて、前記ステータコアとその巻線、またはステータコア，その巻線およびこの巻線に接続されたプリント板をそれぞれ一括してプラスチック樹脂で射出成形または注型成形することを特徴としている。

【0010】第2の発明では、ハウジングの内筒部に固定された軸受を介して回転自在に支持された磁気ディスクを搭載するハブと、このハブと一体的に形成され界磁用永久磁石を有するロータと、巻線が巻装されハウジングの外筒部に装着され前記界磁用永久磁石と僅かな間隙を以て対向するように配置されるステータとを有してなる磁気ディスク駆動用スピンドルモータにおいて、前記ロータと界磁用永久磁石との間に、プラスチックまたはゴム性のリング状弾性体を介在させて、界磁用永久磁石をロータに固定支持することを特徴としている。

【0011】第3の発明では、ハウジングの内筒部に固定された軸受を介して回転自在に支持された磁気ディスクを搭載するハブと、このハブと一体的に形成され界磁用永久磁石を有するロータと、ハウジングの円筒外周部に装着され前記界磁用永久磁石に対し僅かな空隙を以て

図である。すなわち、ステータコア９に巻線８を巻装し、ＦＰＣ１０に巻線８のリード線８ａをハンダ付けした状態で成形金型１８に装着する。成形金型１８の溝面１８ａ，１８ｂの対向寸法はステータコア９の積層寸法と同じであり、溝面１８ｃはステータコア９の外径と嵌合する直径寸法とし、成形金型１８のボス１９の直径寸法はハウジング６の円筒部７の外筒部７ａの直径寸法と同じで、かつ溝面１８ｃと同軸に形成されている。また、成形金型１８の溝面１８ｄから溝面１８ｂまでの寸法Ｌｙは、樹脂成形されたステータコア９をハウジング６に取り付けたとき、永久磁石１１との磁気的中心位置が一致する寸法にしている。

【００１９】すなわち、

（１）ティース１３の先端部１３ａを溝面１８ａ，１８ｂで挟み、複数個のティース１３の積層方向（高さ方向）のばらつきを無くし、正確な位置決めができるようにする。

（２）溝面１８ｃによりステータコア９の直径方向の位置決めを行ない、ボス１９を同軸に配置することにより、全円周方向にわたって均一な隙間１６が形成されるようにする。

の如く成形金型の形状，寸法を定めた状態で、成形金型１８の樹脂注入口２０を通してプラスチック樹脂１５を射出成形することにより、ステータコア９と巻線８、またはステータコア９，巻線８およびＦＰＣ１０を一括して一体的に成形する。なお、射出成形する代わりに、液状の樹脂を成形金型に流し込んで注型成形することもできる。

【００２０】図５は図１の成形方法の他の例を説明するための断面図である。これは、ステータコア９の内径部９ａと円筒部７の外筒部７ａとの間の隙間１６に、プラスチック樹脂１５とは別の材料で形成したブッシュ２１を配置して構成したものである。ここで、プラスチック樹脂１５としては比較的固い樹脂、例えばエポキシ系樹脂（ＰＢＴを含む）を使用し、ステータコア９のティース１３の振動を積極的に抑制するようにする。また、ブッシュ２１の材料としては比較的柔らかい樹脂、例えばブチルゴムなどを用いて製作し、これによりステータコア９の振動がハウジング６に伝わるのを抑止するようにする。

【００２１】以上では、主としてステータ側の振動を抑制する場合について説明したが、振動の抑制についてはロータ側についても同様に考慮する必要がある。図６はかかる観点にもとづくこの発明の他の実施例を示す部分断面図である。図６（イ）はロータ３の円筒部の内径面３ａと界磁用永久磁石１１の外周側１１ａとの間に隙間を設け、そこにリング状弾性体２２を挿入したものである。リング状弾性体２２は磁性または非磁性のプラスチック樹脂若しくはゴムで、隙間寸法に合わせて射出成形または注型で作成し、隙間に挿入して接着剤２３で固定する。この他、図示されない治具で界磁用永久磁石１１とロータ３を同軸上に位置決め固定し、隙間にプラスチック樹脂を射出成形してリング状弾性体２２を一体的に製作する方法を採ることもできる。この方法によれば、接着剤を使用せずに済み、また治具で軸偏心がないように同軸上に置くことにより、界磁用永久磁石１１やロータ３の製作寸法誤差を吸収して回転アンバランスを僅少にすることができる。

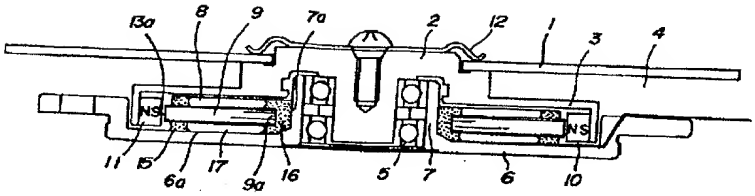
【００２２】ところで、ロータ３は磁性体で作られており、その円筒部は界磁用永久磁石１１の継鉄（ヨーク）の役目も果たしている。したがって、この円筒部と界磁用永久磁石１１との間に隙間を開けリング状弾性体２２を挿入すると、そのヨークとしての効果が減少して界磁用永久磁石１１の磁束量が減少することがある。この場合は、リング状弾性体２２の材料として鉄粉などを混入した磁性プラスチック樹脂、または磁性ゴムを使用することにより、磁束量が減少しないようにすることができる。

【００２３】図６（ロ）に（イ）の変形例を示す。これは、界磁用永久磁石１１の一側面１１ｂと対向するロータ３の一側面３ｂとの間に、中空円板状弾性体２４を挿入したものである。つまり、界磁用永久磁石１１の側面からロータ３に伝わる振動をも減衰させる目的で構成したものであり、中空円板状弾性体２４の材質を非磁性とすることにより、界磁用永久磁石１１の側面からロータ３に漏洩する磁束を低減する効果もある。その組み立て，製作方法はリング状弾性体２２を磁性体、中空円板状弾性体２４を非磁性体とする場合は別々に作って接着剤で固定し、磁性または非磁性の同材料とする場合は、（イ）の場合と同様に治具を用いて一体的に射出成形することもできる。

【００２４】図６（ハ）にさらに別の変形例を示す。これは、界磁用永久磁石１１をプラスチック樹脂による射出成形でその全体を覆ったものである。すなわち、図示されない治具でロータ３と界磁用永久磁石１１を同軸上になるように位置決めしつつ接着剤２３により、界磁用永久磁石１１の一側面１１ｂをロータ３の一側面３ｂに仮り止めしておく。その後、図示されない別の治具を用い、界磁用永久磁石１１全体を覆うようにプラスチック樹脂２５を射出成形して製作する。このようにすれば、図６（イ）と同様の効果を持たせることができるだけでなく、モータ組み立て時の接触衝撃による界磁用永久磁石１１の割れや欠けが発生し難くなり、さらには発生した微小な磁石片が飛び散らないため、その磁気ディスクへの付着を無くすことができる。この場合、プラスチック樹脂２５は非磁性とするのが良い。

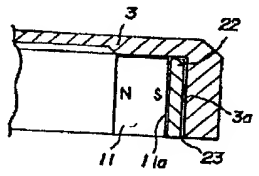
【００２５】図７にこの発明のさらに他の実施例を示す。同図からも明らかなように、この実施例はステータとロータの双方に工夫をこらしたもので、ステータ側については図１に示すものと構造，作用も同じなのでその

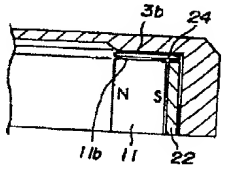
【図1】

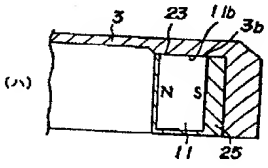


1：磁気ディスク、2：ハブ、3：ロータ、4：挿入空間、5：軸受、6：ハウジング
7：円筒部、8：巻線、9：ステータコア、10：フレキシブルプリント板（FPC）
11：永久磁石、12：固定金具、13a：ティース先端、14，16：隙間、
15：プラスチック樹脂、17：コイルエンド端面

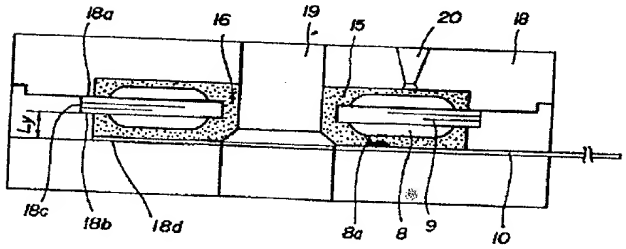
【図6】



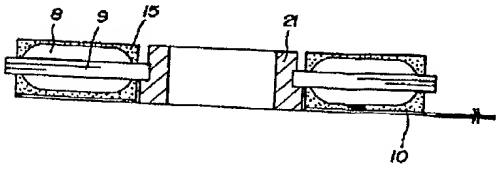




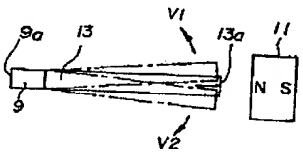
【図4】



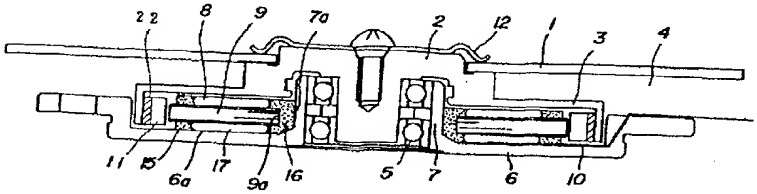
【図5】



【図10】



【図7】



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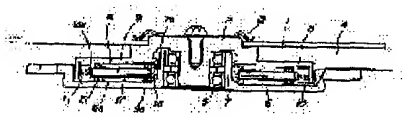
(54) SPINDLE MOTOR FOR DRIVING MAGNETIC DISC

(57)Abstract:
PURPOSE: To suppress noise by lessening at least one side of a stator and a rotor.
CONSTITUTION: The vibration and the noise mainly in a stator are suppressed while lessening the influence of dust by injection-molding or cast-molding a stator core 9 and its winding 8, or the stator core 9, its winding 8 and a printed board 10 for letting a current to this winding 8 each integrally, with plastic resin 15, and similarly the vibration on rotor side can be suppressed by paying attention to the structure, too, on rotor side 3, and further the vibration of both the stator and the rotor can be suppressed.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The hub in which it has a permanent magnet for fields, and is supported free [rotation] through the bearing fixed to the interior of a cylinder of housing, and a magnetic disk is carried, The cylinder periphery section of housing is equipped and the aforementioned permanent magnet for fields is received. few openings With, the stator core arranged so that it may counter, In the spindle motor for a magnetic-disk drive which comes to have the coil which is wound around this stator core and is electrically connected to the printed circuit board The spindle motor for a magnetic-disk drive which bundles up the printed circuit board connected to the aforementioned stator core, its coil or a stator core, its coil, and this coil, respectively, and is characterized by injection molding or carrying out cast molding by the plastics resin.
[Claim 2] The hub in which the magnetic disk supported free [rotation] through the bearing fixed to the container-liner section of housing is carried, With, it sets to the spindle motor for a magnetic-disk drive which comes to have the stator arranged so that it may counter. Rota which is formed in one with this hub and has a permanent magnet for fields, and a coil are looped around, and the sheath section of housing is equipped -- having -- the aforementioned permanent magnet for fields, and few clearances -- The spindle motor for a magnetic-disk drive characterized by making the ring-like elastic body of plastics or rubber nature intervene between aforementioned Rota and the permanent magnet for fields, and carrying out fixed support of the permanent magnet for fields in Rota.
[Claim 3] The hub in which the magnetic disk supported free [rotation] through the bearing fixed to the container-liner section of housing is carried, Rota which is formed in one with this hub and has a permanent magnet for fields, and the cylinder periphery section of housing are equipped, and the aforementioned permanent magnet for fields is received. few openings With, the stator core arranged so that it may counter, In the spindle motor for a magnetic-disk drive which comes to have the coil which is wound around this stator core and is electrically connected to the printed circuit board the printed circuit board connected to the aforementioned stator core, its coil or a stator core, its coil, and this coil -- respectively -- bundling up -- a plastics resin -- injection molding -- or, while carrying out cast molding The spindle motor for a magnetic-disk drive characterized by making the ring-like elastic body of a plastics resin or rubber nature intervene between aforementioned Rota and the permanent magnet for fields, and carrying out fixed support of the permanent magnet for fields in Rota.
[Claim 4] The spindle motor for a magnetic-disk drive according to claim 1 or 3 characterized by preparing an opening between the bore section of the aforementioned stator core, and the cylinder periphery section of housing with which a stator core fits in, and making a plastics resin intervene in this opening.
[Claim 5] The spindle motor for a magnetic-disk drive according to claim 1 or 3 characterized by preparing an opening between the bore section of the aforementioned stator core, and the cylinder periphery section of housing with which a stator core fits in, fitting in the bush which consists of a material of comparatively low elasticity in this opening, and supporting a stator core in this bush.
[Claim 6] The spindle motor for a magnetic-disk drive according to claim 2 or 3 characterized by giving magnetism by mixing the magnetic substance which contains iron powder in the ring-like elastic body of the aforementioned plastics resin or rubber nature.

[Claim 7] The spindle motor for a magnetic-disk drive according to claim 2 or 3 characterized by preparing an opening between the 1 side face of the aforementioned permanent magnet for fields, and the side face of Rota which counters this, and inserting the hollow disc-like elastic body of a nonmagnetic plastics resin or rubber nature in the meantime.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to DC brush loess spindle motor for a magnetic-disk drive (only henceforth a spindle motor) used for a comparatively small magnetic disk unit.
[0002]
[Description of the Prior Art] In recent years, it is almost the case that the small magnetic disk unit used for the portable personal computer with which 3.5 inches -> 2.5 inches -> 1.8 inches, miniaturization, and thin shape-ization are advanced, and a magnetic disk unit is also called especially notebook computer in connection with downsizing-izing of a computer is designed in the height of 1/2 inch or less. In connection with this, a thin shape is required very much for example, of a shaft-orientations overall-height dimension to the spindle motor used with such equipment as 7mm or less in many cases. Moreover, reservation of motor performances, such as shock-proof reservation, a starting torque, etc. accompanied by a cellular phone, will also be demanded collectively.
[0003] Drawing 8 is a cross section showing the conventional example of this kind of spindle motor. That is, to the hub 2 equipped with a magnetic disk 1, Rota 3 made in one with this secures the insertion space 4 of the magnetic head (he has no illustration), and the magnetic disk 1 is formed caudad. Moreover, Rota 3 is supported free [rotation by bearing 5], and is being fixed to housing 6. On the other hand, with adhesives, bore section 9a of the stator core 9 looped around the coil 8 is pasted up or pressed fit in sheath section 7a of the body 7 of the housing 6 with which bearing 5 is inserted, and is being fixed to it in same axle with Rota 3. Here, on the other hand, Rota 3 is rotated by ** according to the electromagnetic force generated between the permanent magnets 11 with which a stator core 9 and Rota 3 were equipped by carrying out the conduction control of the current in the sequence defined beforehand from the drive circuit which is not illustrated at a coil 8 through the flexible printed circuit board (henceforth FPC) 10 connected to the coil 8. in addition, the magnetic disk 1 -- the fixed metallic ornaments 12 -- a hub 2 -- receiving -- the same axle -- and it is fixed in one and rotates
[0004] The thickness of the motor section is very thin, and in order to secure motor performances, such as a starting torque, the diameter of the motor section is large so that clearly also from the above explanation. For example, the value like about 30phi is demanded as an outer diameter of about 4mm and Rota 3 as a height from the inferior surface of tongue of housing 6 to the top of Rota 3. in addition, it is required that it is a low ambient noise (for example, less than [40dBA]:A -- abbreviation of overall -- it is -- a perimeter wave number field -- crossing -- ** -- the meaning to say is expressed), that there is no occurrence of dust, that shock resistance is large, etc. Here, the dimension of a stator core is considered. If the thickness ts of the stator core 9 in drawing 8 is very thin when a coil, the thickness tw, etc. of thickness tr of Rota 3, thickness th of housing 6, and the coil 8 are deducted, for example, the height from the inferior surface of tongue of housing 6 to the top of Rota 3 is set to about 4mm, the dimension of not a mm can be taken. On the other hand, in order to secure a motor performance, the outer diameter of Rota 3 is large, and the radial dimension Ls of a stator core 9 becomes long.
[0005] Next, vibration of a stator core is considered. The plan of the motor which drawing 9 shows the relation between the stator core of drawing 8 and a permanent magnet, the A-A cross section [in drawing 9 in drawing 10] of teeth, and the drawing 11 are schematic diagrams for explaining a position gap of the height orientation of the permanent magnet of a stator core. As mentioned above, as shown in drawing 8 , the teeth section (13) of a stator core 9 Namely, since [that thickness ts is very thin and] the radial length Ls is comparatively long, Since the type of the sheet metal prolonged in the radial is accomplished to radial as shown in drawing 9 , and bore section 9a of a stator core 9 is moreover being fixed to sheath section 7a of the body 7 which is not illustrated in drawing 9 and the drawing 10 , Point 13a of teeth 13 has the structure of being very easy to sway in the orientation shown in drawing 10 by V1 and V2. And teeth point 13a will vibrate [to the coil 8 (refer to the drawing 8) with which each teeth 13 were equipped] in cantilever by carrying out the conduction control of the current in the orientation shown in drawing 10 by V1 and V2 with the electromagnetic force committed between a permanent magnet 11 and each teeth 13.
[0006] It is pointed out that it is easy to produce the above vibration especially when the relative position of a stator core 9 and the permanent magnet 11 causes a position gap in the motor height orientation (shaft orientations), as shown in drawing 11 . That is, the magnetic center gap Lx with a stator core 9 and the permanent magnet 11 is in the inclination that vibration also becomes large so that vibration will occur and Lx will become large, if this is also slight. This magnetic center gap Lx is generated with the camber and deflection by handling of the manufacturing process of a stator core 9, or a coil process, and the sizes also differ for every teeth. Moreover, in case a stator core 9 is attached in housing 6, it generates also with an installation error or an inclination.

Therefore, it will be said that it is almost impossible to lose the magnetic center gap Lx about all teeth.
[0007]
[Problem(s) to be Solved by the Invention] by the way -- if there is not only a possibility of misreading the data on a magnetic disk, but [when the above vibration arises,] this is in agreement with the commutation frequency of the current which flows to a coil -- very jarring electromagnetism -- an ambient noise is generated Moreover, vibration will be transmitted from bore section 9a of a stator core 9 to the body 7 of drawing 8 , the housing 6 whole will be vibrated, and an ambient noise will increase further. One example of the ambient noise analysis spectrum of the spindle motor by the configuration of drawing 8 is shown in drawing 12 . In accordance with the energization control frequency (commutation frequency) of the current to which f1 of this drawing flows to a coil, f2 and f3 show the frequency of the integral multiple. This is also the cause of it not only cannot satisfying the ambient noise value demanded, but being the very jarring unique sound which cannot be expressed with an ambient noise value, and vibrating the whole motor and the whole magnetic disk unit.
[0008] Here, dust is considered. That is, a manufacture of a stator core and a coil and an erector can consider that dust adheres by a certain cause in a grade. Although clarification is carried out for every manufacturing process and most dust is removed, while each part article is manufactured in the air-conditioned pure interior of a room, if few dust which has adhered to the coil, for example in a coil process is involved in together at the time of a coil, even if it depends purely, it is difficult to remove this. This dust will adhere to a magnetic disk 1 through Rota 3 shown in drawing 8 during use of a motor, and the opening 14 between housing 6, and the magnetic head and the magnetic disk 1 which are not illustrated will be damaged. Therefore, the technical probrem of this invention is to lessen [suppressing vibration and reducing an ambient noise and] influence of dust as much as possible further.
[0009]
[Means for Solving the Problem] In order to solve such a technical probrem, in the 1st invention The hub in which it has a permanent magnet for fields, and is supported free [rotation] through the bearing fixed to the interior of a cylinder of housing, and a magnetic disk is carried, The cylinder periphery section of housing is equipped and the aforementioned permanent magnet for fields is received. few openings With, the stator core arranged so that it may counter, In the spindle motor for a magnetic-disk drive which comes to have the coil which is wound around this stator core and is electrically connected to the printed circuit board The printed circuit board connected to the aforementioned stator core, its coil or a stator core, its coil, and this coil is put in block, respectively, and it is characterized by injection molding or carrying out cast molding by the plastics resin.
[0010] The hub in which the magnetic disk supported free [rotation] through the bearing fixed to the container-liner section of housing in the 2nd invention is carried, With, it sets to the spindle motor for a magnetic-disk drive which comes to have the stator arranged so that it may counter. Rota which is formed in one with this hub and has a permanent magnet for fields, and a coil are looped around, and the sheath section of housing is equipped -- having -- the aforementioned permanent magnet for fields, and few clearances -- The ring-like elastic body of plastics or rubber nature is made to intervene between aforementioned Rota and the permanent magnet for fields, and it is characterized by carrying out fixed support of the permanent magnet for fields in Rota.
[0011] The hub in which the magnetic disk supported free [rotation] through the bearing fixed to the container-liner section of housing in the 3rd invention is carried, Rota which is formed in one with this hub and has a permanent magnet for fields, and the cylinder periphery section of housing are equipped, and the aforementioned permanent magnet for fields is received. few openings With, the stator core arranged so that it may counter, In the spindle motor for a magnetic-disk drive which comes to have the coil which is wound around this stator core and is electrically connected to the printed circuit board the printed circuit board connected to the aforementioned stator core, its coil or a stator core, its coil, and this coil -- respectively -- bundling up -- a plastics resin -- injection molding -- or, while carrying out cast molding The ring-like elastic body of a plastics resin or rubber nature is made to intervene between aforementioned Rota and the permanent magnet for fields, and it is characterized by carrying out fixed support of the permanent magnet for fields in Rota.
[0012] In addition, in the above 1st or the 3rd invention, an opening can be prepared between the bore section of the aforementioned stator core, and the cylinder periphery section of housing with which a stator core fits in, the bush which a plastics resin is made to intervene in this opening, or consists of a material of comparatively low elasticity can be fitted in, and a stator core can be supported in this bush. Moreover, in the above 2nd or the 3rd invention, by mixing the magnetic substance which contains iron powder in the ring-like elastic body of the aforementioned plastics resin or rubber nature, magnetism can be given, or an opening can be prepared between the 1 side face of the aforementioned permanent magnet for fields, and the side face of Rota which counters this, and the hollow disc-like elastic body of a nonmagnetic plastics resin or rubber nature can be inserted in the meantime.
[0013]
[Function] The printed circuit board connected to a stator core, its coil or a stator core, its coil, and this coil is put in block, respectively, vibration is suppressed injection molding or by carrying out a casting by the plastics resin, and influence of dust is lessened. Moreover, an opening is prepared between the bore section of a stator core, and the cylinder periphery section of housing with which a stator core fits in, the bush which a plastics resin is made to intervene in this opening, or consists of a material of comparatively low elasticity is fitted in, and the vibration is made not to be transmitted to housing by supporting a stator core in this bush. Furthermore, suppression of vibration is aimed at by making a plastics resin or rubber intervene between the periphery section of the above-mentioned permanent magnet for fields, and the Rota inner circumference section, or combining such technique.
[0014]

[Example] Drawing 1 is a block diagram showing the example of this invention, and shows the cross section of a spindle motor. This carries out injection molding of a coil 8, the stator core 9 or the coil 8, the stator core 9, and FPC10 in one with the plastics resin 15, and in the body 7 of housing 6, they carry out pressing or adhesion fixation and it constitutes them. Moreover, as for sheath section 7a of a body 7, bore section 9a of a stator core 9 is made not to contact directly, and vibration of a stator core 9 is made not to travel to housing 6 by embedding the plastics resin 15 in the opening 16 between bore section 9a of a stator core 9, and the body 7. On the other hand, field 6a by the side of the interior of a motor of housing 6 is in contact with the coil and the end face 17 of a coil 8 which were unified by the plastics resin 15, and the molding dimension of a plastics resin is beforehand defined so that the magnetic center of a permanent magnet 11 and the stator core 9 may be in agreement by this. Moreover, since field 6a, the coil, and the end face 17 by the side of the interior of a motor have contacted, the inclination at the time of installation of a stator core 9 can also be lost. In addition, other points are the same as that of the conventional example.

[0015] Since the stator-core 9 whole is covered in one with the plastics resin 15 and it is hardened here although a deflection arises in the point of the teeth which electromagnetic force occurs between a permanent magnet 11 and the stator core 9 as well as the case where it is the conventional example, and are not illustrated by this if the energization control of the current is now carried out from the drive circuit which is not illustrated through FPC10 to a coil 8, the motion will be suppressed. Moreover, since the stator core 9 does not touch directly in the body 7 of housing 6 by the opening 16, vibration does not travel to housing 6 directly. Here, the material which has elasticity suitable as a plastics resin 15, and does not have a bad influence on a magnetic disk 1, for example, a polybutylene-terephthalate (PBT) resin etc., is used.

[0016] Drawing 2 and the drawing 3 are frequency-spectrum views showing the ambient noise property of a spindle motor, and are measured on the same conditions as drawing 12 . Although drawing 2 is the spindle motor which injection molded a coil 8, the stator core 9, and FPC10 in one with the plastics resin 15, it is a noise spectrum at the time of contacting bore section 9a of a stator core 9 to sheath section 7a of a body 7 directly, and pasting up. It turns out that it is decreasing as compared with the case where the energization control frequencies (commutation frequency) f1, f2, and f3 which flow to a coil 8 are drawing 12 so that clearly from this drawing. However, since vibration of a stator core 9 is transmitted to the direct housing 6, although climax of the spectrum of first and the secondary commutation frequency f1 which are shown in drawing 12 , and the f2 neighborhood is small, it has not necessarily been lost completely in drawing 2 .

[0017] On the other hand, when drawing 3 embeds the plastics resin 15 in the opening 16 between bore section 9a of a stator core 9, and the body 7, bore section 9a of a stator core 9 is a noise spectrum when sheath section 7a of a body 7 is made not to contact directly. It not only decreases further, but according to this drawing, climax of the spectrum of the commutation frequency f2 second neighborhood has disappeared from the case where the level of the commutation frequencies f1, f2, and f3 is drawing 2 . This is considered because transmission in the housing 6 of vibration is suppressed by having filled the opening 16 with the plastics resin 15. In addition, when one example of a noise-measurement result is shown, in about 40 dBAs and the drawing 2 , the ambient noises in the case of drawing 12 are 33dBAs, and understand that what is depended on this invention is excellent in the noise-control effect of No. 1 in 36dBAs and the drawing 3 .

[0018] explanatory drawing for drawing 4 explaining one example of the technique of carrying out injection molding of a coil 8, the stator core 9, and FPC10 in one -- it is -- molding -- it is the cross section showing the status that it inserted in metal mold 18 namely, the status that looped the stator core 9 around the coil 8, and lead-wire 8a of a coil 8 was soldered to FPC10 -- molding -- metal mold 18 is equipped molding -- the diameter dimension into which the opposite dimension of **** 18a and 18b of metal mold 18 is the same as the laminating dimension of a stator core 9, and **** 18c fits with the outer diameter of a stator core 9 -- carrying out -- molding -- the diameter dimension of the boss 19 of metal mold 18 is the same as the diameter dimension of sheath section 7a of the body 7 of housing 6, and is formed in **** 18c and the same axle moreover, molding -- the dimension Ly from 18d of ****s of metal mold 18 to **** 18b is made into the dimension whose magnetic center position with a permanent magnet 11 corresponds when the stator core 9 by which resin molding was carried out is attached in housing 6

[0019] That is, point 13a of the (1) teeth 13 is inserted by **** 18a and 18b, dispersion in the orientation (the height orientation) of a laminating of two or more teeth 13 is abolished, and it can be made to perform an exact positioning.

(2) The diameter orientation of a stator core 9 is positioned by **** 18c, and the uniform opening 16 is formed over all circumferencial directions by stationing a boss 19 on the same axle.

** -- like -- molding -- the status that the configuration of metal mold and the dimension were defined -- molding -- a stator core 9, the coil 8 or the stator core 9, the coil 8, and FPC10 are collectively fabricated in one by carrying out injection molding of the plastics resin 15 through the resin inlet 20 of metal mold 18 in addition, a resin liquefied instead of carrying out injection molding -- molding -- cast molding can also be slushed and carried out to metal mold

[0020] Drawing 5 is a cross section for explaining other examples of the molding technique of drawing 1 . This arranges and constitutes the bush 21 formed in the opening 16 between bore section 9a of a stator core 9, and sheath section 7a of a body 7 with material with the another plastics resin 15. Here, as a plastics resin 15, a comparatively hard resin (PBT is included), for example, an epoxy system resin, is used, and vibration of the teeth 13 of a stator core 9 is suppressed positively. Moreover, as a material of a bush 21, it manufactures using a comparatively soft resin, for example, isobutylene isoprene rubber etc., and inhibits that vibration of a stator core 9 travels to housing 6 by this.

[0021] Although the case where the vibration by the side of a stator was mainly suppressed was explained above, it is necessary to take [suppression / of vibration] into consideration similarly about the Rota side. Drawing 6 is a fragmentary sectional view showing other examples of this invention based on such a viewpoint. Drawing 6 (b) prepares an opening between bore side 3a of the body of Rota 3, and periphery side 11a of the permanent magnet for fields 11, and inserts the ring-like elastic body 22 there.

The ring-like elastic body 22 is magnetic or nonmagnetic a plastics resin or rubber, it is doubled with an opening dimension, is created by injection molding or the casting, is inserted in an opening, and is fixed with adhesives 23. In addition, the technique of carrying out positioning fixation of the permanent magnet for fields 11 and Rota 3 on the same axle with the fixture which is not illustrated, carrying out injection molding of the plastics resin to an opening, and manufacturing the ring-like elastic body 22 in one can also be taken. According to this technique, it is not necessary to use adhesives and, the permanent magnet for fields 11 and the work measurement error of Rota 3 can be absorbed by placing on the same axle with a fixture, so that there may be no axial eccentricity, and rotation imbalance can be made small.

[0022] By the way, Rota 3 is made from the magnetic substance and the duty of the yoke (yoke) of the permanent magnet for fields 11 has also achieved the body. Therefore, when an opening is opened between this body and the permanent magnet for fields 11 and the ring-like elastic body 22 is inserted in it, the effect as the yoke may decrease and the amount of magnetic flux of the permanent magnet for fields 11 may decrease. In this case, the amount of magnetic flux can be prevented from decreasing by using the magnetic plastics resin which mixed iron powder etc. as a material of the ring-like elastic body 22, or a magnetic rubber.

[0023] The modification of (b) is shown in drawing 6 (b). This inserts the hollow disc-like elastic body 24 between 1 side-face 3b of Rota 3 which counters with 1 side-face 11b of the permanent magnet for fields 11. That is, it constitutes in order to also attenuate vibration transmitted from the side face of the permanent magnet for fields 11 to Rota 3, and it is effective in reducing the magnetic flux revealed to Rota 3 from the side face of the permanent magnet for fields 11 by making nonmagnetic the quality of the material of the hollow disc-like elastic body 24. It assembles, and when it makes separately and they are fixed with adhesives, when [that] making the magnetic substance and the hollow disc-like elastic body 24 into non-magnetic material, and making the ring-like elastic body 22 into this magnetic or nonmagnetic material, injection molding of the manufacture technique can also be carried out in one like the case of (b) using a fixture.

[0024] Still another modification is shown in drawing 6 (c). This covers the whole with injection molding according the permanent magnet for fields 11 to a plastics resin. That is, with the fixture which is not illustrated, positioning Rota 3 and the permanent magnet for fields 11 so that it may become on the same axle, with adhesives 23, 1 side-face 11b of the permanent magnet for fields 11 is temporary-stopped to 1 side-face 3b of Rota 3, and is set to it. Then, using another fixture which is not illustrated, injection molding of the plastics resin 25 is carried out, and it is manufactured so that the permanent magnet 11 whole for fields may be covered. If it does in this way, since the minute piece of a magnet which the crack and chip of the permanent magnet for fields 11 by the contact impact at the time of a motor assembly came to seldom generate, and it not only can give the same effect as drawing 6 (b), but was generated further will not scatter, adhesion to the magnetic disk can be lost. In this case, as for the plastics resin 25, considering as nonmagnetic is good.

[0025] The example of further others of this invention is shown in drawing 7 . Since the same is said of the thing and structure which this example is what elaborated the device on a stator and the both sides of Rota, and are shown in drawing 1 about a stator side, and an operation, the explanation is omitted and is explained below about the difference with drawing 1 , so that clearly from this drawing. That is, the ring-like elastic body 22 made from the **** plastics resin or rubber explained in drawing 6 is formed between the permanent magnet for fields 11, and the body of Rota 3. If it carries out like this, vibration of the permanent magnet for fields 11 produced with the electromagnetic force committed between the permanent magnet for fields 11 and the stator core 9 will decline by this ring-like elastic body 22, and will almost cease to travel to Rota 3. Rubber can be used, when the material with the same moderate elastic force as the plastics 15 which injection molded the stator core 9 etc., for example, PBT resin, can be used and it gives a damping effect further as this ring-like elastic body 22.

[0026]

[Effect of the Invention] According to this invention, the following effects are expectable.

(1) since it is made to fabricate a stator core etc. by the plastics resin in one -- the electromagnetism at the time of commutation -- the vibration based on exciting force is suppressed and a motor noise is reduced

(2) Since it was made to make the plastics resin which has suitable elasticity between a stator-core bore and housing intervene, vibration of a stator core is not transmitted to housing, but, as a result, a motor noise and vibration are reduced remarkably.

(3) Since the dust which adheres to a coil etc. and is not removed by washing etc. since a stator core, a coil, and FPC were fabricated in one by the plastics resin is closed and it may not be made not to take out outside, don't affect [bad] a magnetic disk unit and, as a result, a reliability improves sharply.

(4) Since the plastics resin was made to perform the above-mentioned closure, washing work of the flux (solvent) elimination after a coil process and FPC lead-wire soldering etc. becomes simplification or omissible, and a reduction of a cost can be aimed at.

(5) By preparing a ring-like elastic body or a hollow disc-like elastic body between the permanent magnet for fields, and Rota, the electromagnetic force which travels to the Rota side declines, and a motor noise and vibration decrease.

(6) Adhesion to the magnetic disk of the piece of a magnet by the crack and chip of the above-mentioned permanent magnet for fields can be lost.

(7) By giving magnetism to the above-mentioned ring-like elastic body, a reduction of the magnetic flux by the permanent magnet for fields can be suppressed.

In addition, an oscillating depressor effect can be further raised by combining suitably either of above-mentioned either of - (3) and (1)(4) - (7).

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section showing the example of this invention.
[Drawing 2] It is the property view showing the ambient noise analysis spectrum at the time of fixing a stator core directly in a housing body.
[Drawing 3] It is the property view showing the ambient noise analysis spectrum at the time of making a plastics resin intervene between a stator-core bore and housing.
[Drawing 4] It is explanatory drawing for explaining the molding technique of drawing 1 .
[Drawing 5] It is the cross section showing other examples of the molding technique of drawing 1 .
[Drawing 6] It is the cross section showing other examples of this invention.
[Drawing 7] It is the cross section showing the example of further others of this invention.
[Drawing 8] It is the cross section showing the conventional example of a spindle motor.
[Drawing 9] It is the plan showing the stator core of drawing 8 , and the relation of a permanent magnet.
[Drawing 10] It is the cross section which cut the teeth of a stator core by the A-A page of drawing 9 .
[Drawing 11] It is explanatory drawing for explaining the gap of the height orientation to the permanent magnet of a stator core in drawing 8 .
[Drawing 12] It is the property view showing the ambient noise analysis spectrum of a spindle motor shown in drawing 8 .
[Description of Notations]
1 [-- Rota, 4 / -- Insertion space, 5 / -- Bearing,] -- A magnetic disk, 2 -- A hub, 3 6 [-- The sheath section 8 / -- A coil, 9 / -- Stator core,] -- Housing, 7 -- A body, 7a 9a [-- Permanent magnet,] -- The bore section, 10 -- The flexible printed circuit board (FPC), 11 12 [-- A teeth point, 14, 16 / -- Opening,] -- Fixed metallic ornaments, 13 -- Teeth, 13a 15, 25 [-- Molding metallic ornaments, 18a-18d / -- **** 19 / -- A boss, 20 / -- A resin inlet, 21 / -- A bush, 22 / -- A ring-like elastic body, 23 / -- Adhesives 24 / -- Hollow disc-like elastic body.] -- A plastics resin, 17 -- A coil and an end face, 18

[Translation done.]